

**SUWANNEE
RIVER
WATER
MANAGEMENT
DISTRICT**

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TECHNICAL REPORT

BUFFER ZONE STUDY

FOR

**SUWANNEE RIVER
WATER MANAGEMENT DISTRICT**

SEPTEMBER 8, 1988

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BUFFER ZONE STUDY
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

I. INTRODUCTION

As part of its responsibilities under the Surface Water Improvement and Management Act (SWIM), the Suwannee River Water Management District (SRWMD) reviewed the natural resources impacts on several developments constructed or proposed for construction in riverine floodplains. The district's staff was concerned that existing regulations were not adequate to protect the diverse natural resources of riverine floodplains from the impacts of medium and high density developments. Development adjacent to the district's rivers and creeks was resulting in a loss of wildlife habitat and an increase in soil erosion and water pollution. In an effort to expand its ability to provide additional protection to resources and water quality, the SRWMD contracted with Dames & Moore, an environmental consulting firm, to develop a buffer zone for the Suwannee River that would protect the river's natural resources.

The consultant would accomplish the following tasks:

1. Conduct a brief literature survey to determine the approaches taken by other Florida water resources organizations and other state governments to develop natural resources buffer zones.
2. Develop a buffer zone methodology based on the use of the U.S. Soil Conservation Service (SCS) TR-55 rainfall/runoff model, an established model widely accepted and used throughout government and industry, and test this methodology at three representative sites along the Suwannee River.
3. Conduct an assessment of the efficacy of the state's septic tank rule in the counties along the Suwannee River and determine if any proposed rule changes would affect the district.

A buffer zone can be equated to the commonly used land planning term "setback", wherein a particular structure must be situated a predetermined distance away from a land use feature such as a road or a neighboring property. In essence, a buffer zone is a setback designed to protect a natural resource or feature from the direct impacts of development. Currently, SRWMD policy allows for a setback (or buffer zone) of 75 feet from open water for single family residences. (See Figure 1.) This setback is a minimum threshold designed primarily to protect water quality from direct runoff from impervious surfaces. The current 75 foot setback line does not, however, provide adequate water quality protection against the runoff from medium to high density development located adjacent to waterbodies. Also, the current setback does not provide adequate protection from the clearing of

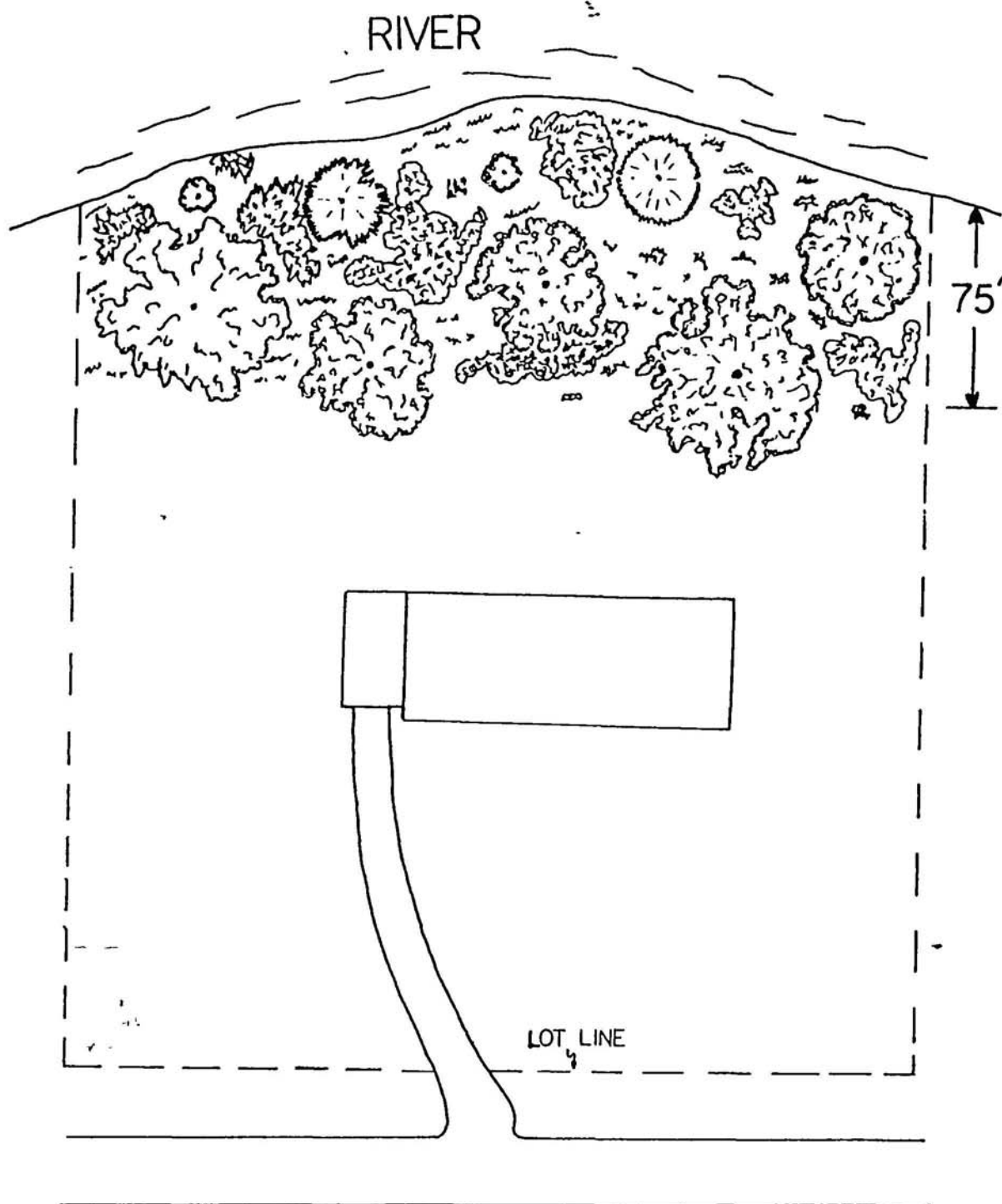


Figure 1. SRWMD Buffer Strip

vegetation that binds floodplain soils and keeps them from eroding into the waterbody.

At the present time, a 75 foot buffer strip is required along any jurisdictional water within the SRWMD. The buffer strip is to contain natural vegetation and extend back from the normally recognized bank of the water. This requirement was adopted as a rule in Chapter 40B-4, Surface Water Management Works of the District in 1985. The basis for selecting a 75 foot buffer in the District dates back to the mid-1960's when the Suwannee River was being considered for designation at the federal level as a Wild and Scenic River. As part of the conditions for this designation, a setback, or buffer strip, of 75 feet from the river bank was proposed primarily for aesthetic purposes.

Although the Suwannee River ultimately was never designated as a Wild and Scenic River, the provision for a 75 foot buffer strip continued to be discussed by various organizations. In the 1970's, the Suwannee River Resources Planning and Management Committee, under the authority of Chapter 380, Florida Statutes, recommended the adoption by local government of a 75 foot buffer strip along the Suwannee River. By 1982, all the counties along the river had implemented ordinances requiring the 75 foot buffer strip within which only very limited destruction of vegetation was allowed. In 1984, the SRWMD began the process of incorporating all the county and local ordinances for the Suwannee River into the broader context of the entire District, culminating in the 75 foot requirement being incorporated into Chapter 40B-4.

To date, the 75 foot buffer strip appears to be effective for its intended purpose, which is the protection of waterbodies from typical activities along the river, especially the construction of single family homes. The question is now arising as to the effectiveness of the 75 feet if more intense development occurs. This report attempts to answer that question by demonstrating a method by which larger buffer strips could be implemented as the intensity of development goes beyond that of the typical single family home unit.

Ideally, buffer zones should both protect floodplain vegetation and soil and minimize runoff so as to maintain post-development water quality and quantity in the receiving waterbody to that of the natural or pre-development condition. It must be realized however, that this ideal condition can never be met under practical conditions. The realistic purpose of a buffer zone, therefore, is to minimize the adverse environmental impacts of floodplain development activity and not to eliminate them entirely.

SRWMD wanted to have a method of deriving buffer zone distances which was fairly simple to implement and would provide flexibility in its application. The district also desired that

the method be capable of providing buffer zones which would vary in width according to actual conditions; that is, a site specific buffer zone, an activity specific buffer zone, or a combination.

II. OTHER PLANNING AND REGULATORY APPROACHES TO THE USE OF NATURAL RESOURCES BUFFER ZONES

In order to properly evaluate both the district's existing 75 foot setback requirement and the proposed buffer zone model described in the next section, the consultant reviewed the planning literature to learn how other governmental jurisdictions have regulated natural resource buffer zones. We reviewed the regulatory approaches of seven states who have successfully established buffer zones of setbacks to protect riverine floodplains from development encroachment. The Florida DER, some local governments and the other water management districts were also consulted on their approaches. Finally, as a part of this task, the consultant was asked to review the buffer zone report prepared by the Center for Wetlands.

Coincidentally, during the preparation of this report, the 1988 Florida Legislature adopted the Wekiva River Protection Act, which directed the establishment of buffer zones to protect the river's water quality and floodplain natural resources. The legislature expressed concern for the environmental impacts caused by increasing development encroachment into the floodplain of the Wekiva River. The St. Johns River Water Management District has developed various buffer zones that provide extensive areas of protection. The policy principal applied for the Wekiva River is valid for the SRWMD's desire to protect its riverine natural resources.

1. Review of the Center for Wetlands Buffer Report

"An Evaluation of the Applicability of Upland Buffers for the Wetlands of the Wekiva Basin" (Brown and Schaefer, 1987) introduces the buffer zone concept and discusses the significant benefits buffer zones provide for the maintenance and protection of water quality, water quantity and wildlife habitats for wetland, upland and transitional zone species. The authors did a commendable job amassing and presenting the available, relevant literature, especially in the areas relating to edge (ecotonal) and corridor effects. Several conclusions are readily apparent from their review:

- (1) Limited information is available that directly relates to the establishment of buffer zones;
- (2) The limited direct and considerable indirect evidence suggest that buffer zones are clearly beneficial and necessary for the protection of natural resources;

- (3) Little quantitative information is available which can be used to establish widths of buffer zones; and
- (4) The limited quantitative data that exist suggest highly variable buffer widths, influenced by a variety of factors such as: what organisms are examined, vegetation and soil type present, and topography.

In the latter portion of the report, the Center proposed a method for establishing a flexible-width buffer zone which could be estimated at varying distances along a riverine/wetland shoreline. The buffer methodology was designed for use within the St. Johns River Water Management District (SJRWMD), specifically in the Wekiva River Basin. The width of the buffer zone was based on four factors:

- (1) The St. Johns River Water Management District's wetland line (40C-4, F.A.C.),
- (2) A water quality maintenance factor based on soil erodibility in the immediate vicinity of the wetland line,
- (3) A water quantity maintenance factor based on ground water table depth in the vicinity immediately upland of the wetland line, and
- (4) Habitat requirements of aquatic and wetland-dependent wildlife species.

The 40C-4 Wetland Line. The Center for Wetlands proposes using the SJRWMD wetland line to establish the landward extent of the wetlands (or conversely, the waterward boundary of the buffer zone). This wetland line is not identical, but similar to the Department of Environmental Regulation's wetland jurisdictional line (Chapter 17-4, F.A.C.) and is based on an assessment of dominant vegetation, soils and other indicators of wetland conditions. Dames & Moore agrees with the Center that the use of a wetland jurisdictional line of this nature (e.g., WMD's, DER's, COE's) is an essential first step in buffer delineation.

Once the wetland line is established, the Center proposes evaluating the remaining three factors (discussed below). The final buffer width is determined by what the Center states is the "controlling factor," i.e., the factor calculation that results in the largest buffer zone. While Dames & Moore strongly agrees with the Center's method for determining the boundary of the buffer, we have serious reservations concerning the proposed methodologies used by the Center to calculate buffer widths.

Water Quality Maintenance. The maintenance of water quality in a wetland is suggested by the Center to be "related to the filtering capacity and roughness of natural undisturbed vegetation to minimize inputs of sediments and destructive

velocities of water." Erosion potential and subsequent sediment deposition in the wetland is a function of water velocity, slope and soil erodibility. The Center relates these factors through the following "simple relationship of slope and erodibility" (p. 119; Brown & Schaefer, 1987):

$$B_w = \frac{S}{E}^{1/2}, \text{ where: } \begin{array}{ll} B_w &= \text{buffer width} \\ S &= \text{average land slope} \\ E &= \text{Soil erodibility factor; indexed to Soil Conservation Service erosion factors} \end{array}$$

The Center proposes that this equation be evaluated to determine buffer width at any point along the wetland/riverine shoreline.

Dames & Moore offers several observations about the Center's equation. First, while reference is made by the Center to the "filtering capacity... of natural undisturbed vegetation," the authors make no provision to factor into the equation either the type or amount of vegetation present, both of which can profoundly affect runoff quality (and quantity).

Second, the Center makes no provisions in the equation to factor in the influence or presence of anthropogenic materials, (e.g., nutrients, pesticides, heavy metals); in fact, there are no suggestions in the report that environmental chemistry should even be assessed. Water quality is apparently evaluated only as a function of potential erosion, sediment transport, deposition and subsequent turbidity increases in the receiving waterbody. Similarly, there are no provisions to factor in the type of activity from which the buffer protects the wetlands.

Third, the Center presents no clear rationale for using the particular formulation given. While the Center's equation is scaled such that its solution results in intuitively reasonable buffer widths, no empirical data are presented to verify that the calculated buffer width (B_w) in fact provides the proposed level of water quality protection.

The authors state in the report that the above equation should be taken as a "framework" out of which "equations better suited for the conditions encountered" can be developed and that the equation is provided only "as an example for determining buffer requirements..." On this point, Dames & Moore agrees with the Center. We suggest that either field data be collected to substantiate the equation's validity or new methods be examined.

Water Quantity Maintenance. The maintenance of water quantity in a wetland is suggested by the Center to be related only to the influence of drainage structures on the ground water table adjacent to the wetland. These drainage structures (e.g., ditches) interrupt normal ground water flows from the upland to the wetland, cause ground water table drawdown and can result in the lowering of wetland water levels. To minimize this drawdown

on the wetland, the Center proposes that an acceptable setback from the wetland for drainage structures can be calculated from the following highly simplified equation (p. 123; Brown and Schaefer, 1987):

$$B_w = (1.69 D/s) (10^{-1.3/sL})$$

where: B_w = buffer width
 D_w = ditch depth
 L = ditch length
 s = water table surface slope in the vicinity of the ditch

Similar to our comments on the previous equation, Dames & Moore questions the appropriateness of the above calculations for buffer width estimation. First, the equation is a greatly simplified version of a more complex formula, neither of which was accompanied by adequate rationale for use by the Center. Additionally, no discussion was provided by the Center concerning the determination of constant terms in the equation.

Second, the Center assumed a drawdown of 0.25 feet at the wetland edge which is acceptable. The rationale for this acceptable drawdown is unclear. While a drawdown of this magnitude may have negligible impacts on the main stem of a river or the deeper, central portion of a lake, the shallow-water, peripheral areas of a wetland (e.g., shallow marshes, sloughs) may be affected to a greater extent, depending on their elevations and slopes.

Third, the Center provides no empirical data to verify that the calculated buffer width provides the proposed level of protection of water quantity.

Wildlife Habitat Requirements. To provide habitat protection for aquatic and wetland-dependent wildlife species, the Center's authors suggest evaluating four factors: habitat suitability, spatial requirements, access of wetland species to upland and/or transitional habitats and noise impacts. Dames & Moore believes that the lack of technical data on which to assess buffer widths is most evident in this section of the Center's report.

The Center's report lists seven criteria as minimum standards for an area to be considered suitable habitat for a full spectrum of wildlife species. These standards were derived from an extremely limited data set on "several of the more sensitive forest-dwelling wetland-dependent species" (i.e., data were presented for several turtle species, several birds and a snake; Table V.2 in Center's report, p. 125). Dames & Moore feels this is not a representative or adequate sample of a "full spectrum" of species. Additionally, it is unclear from the Center's report how these criteria should be translated into an estimate of buffer width without detailed, field observations.

The Center states that by providing suitable habitat for certain sensitive species that the needs of less sensitive species will automatically be insured. Dames & Moore feels this statement is misleading and not adequate justification for proceeding with only limited data. Sensitive species are usually "sensitive" because of a particular limiting resource requirement. This limiting resource may have little to do with other species. By providing this resource, the sensitive species may be assisted with little benefit to any other species. Dames & Moore suggests that more species specific information be acquired before this type of approach is taken.

A similar lack of quantitative data were available to the Center on the spatial requirements of wildlife species (Table V.2 in report and above discussion indicate the paucity of data). Further aggravating the problem is the fact that none of the cited studies used by the Center were carried out in Florida, or more specifically in the Wekiva Basin. Certainly the fault does not lie with the Center on this issue; few technical data exist which can provide estimates of the spatial needs of wildlife species.

Even less data are available to assess the buffer requirements based on accessibility of wetland species to upland habitats; data were presented by the Center only for turtles and the gopher tortoise. Dames & Moore believes these data are clearly inadequate to assess this wildlife factor.

In conclusion, Dames & Moore feels that the methodologies proposed in the Center for Wetland's report for the establishment of wetland buffer widths are based on either (1) highly simplified, artificially constructed equations with no empirical data to verify their effectiveness in wetland protection, or (2) such limited data as to cast considerable doubt on their general predictability and usefulness. Highly quantitative models are only as good as the data on which they are based. Clearly, considerably more species-specific information, at least collected on a regional basis, is necessary before buffer widths can be quantitatively evaluated based on approaches proposed by the Center. If adequate data are not available from the literature, which we believe to be the case, and cannot be acquired from new research within a relatively short period of time, other approaches should be sought by which reasonable estimates of buffer widths can be objectively determined. Dames & Moore recommends consideration of a qualitative model (see discussion on the New Jersey Pinelands Buffer Model in the following section).

2. Other States Approaches to Wetland Buffers

Dames & Moore briefly reviewed the planning literature to obtain an insight into other states' approaches to the setting of buffer zones or setback lines around wetland areas. To do so we

acquired information from the Strozier Library (Florida State University), the Florida Department of Environmental Regulation Library, the Department of Urban and Regional Planning (Florida State University), the Department of Natural Resources in the states of Delaware, Maryland and Virginia, the Virginia Institute of Marine Science and the Citizens Program for the Chesapeake Bay.

Wisconsin. To deal with development pressures on its aquatic resources, Wisconsin passed the Water Resources Act, Chapter 614, Laws of 1965. In Section 59.971, Wisconsin Statutes, a variety of shoreline zoning provisions were set forth to preserve the natural, historical, cultural and scenic resources that are present near lakes and streams (Burnett and Hansen, 1982). Administered by the Department of Natural Resources, the shoreland zoning program was aimed at controlling water pollution, protecting wildlife habitats and regulating structures and land uses within the shoreline areas.

Under the Act, all Wisconsin counties are required to zone their unincorporated areas lying within 1,000 feet of lakes or ponds, and within 300 feet of rivers or streams, or to the landward side of the floodplain, whichever distance is greater. Within this shoreline zone, counties must regulate a variety of activities including sanitary facilities, subdivisions, tree cutting, building setbacks, drainage alterations and wetlands. Chapter NR 115, Wisconsin Administrative Code, established minimum standards as guidelines which the counties may exceed if desired. A minimum building setback of 75 feet from the ordinary high water mark was set along with regulations governing the removal of vegetation within a 35-foot wide strip parallel to the water.

Wisconsin's approach has merit to the SRWMD's attempts to establish site-specific setback lines. We suggest the district pursue this further by obtaining data from the Wisconsin Department of Natural Resources.

New-Jersey. Although summarized in the Center for Wetlands report, the New Jersey Pinelands buffer is a unique approach to wetland protection and is worth briefly reviewing here. In 1980, the State of New Jersey adopted the New Jersey Pinelands Comprehensive Management Plan which was designed to provide protective regulations for the 445,000 hectare Pinelands National Reserve. The plan prohibits most development in wetlands and establishes a flexible buffer zone, ranging in width from 50 to 300 feet around any wetland.

A buffer delineation model (Roman and Good, 1985, 1986) was developed that incorporates information on three general factors: an evaluation of relative wetland quality, an assessment of potential impacts associated with proposed development, and existing and projected land use. Each factor is evaluated over a series of criteria; for example, relative wetland quality is

assessed by examining the existing vegetation, existing water quality, the ability to maintain water quality, wildlife habitats and sociocultural values such as recreational potential. A particular wetland area is ranked qualitatively for each criterion with a score from 1 to 3. Scores for all criteria for each of the three general factors are averaged and a buffer width is calculated between the minimum and maximum values. A more detailed description of the buffer model can be found in Roman and Good (1985, 1986).

Dames & Moore feels that the above approach, like Wisconsin's, has considerable merit and suggest that the model be examined in more detail for its applicability in the SRWMD.

Maryland. In 1984, the Maryland General Assembly passed the Chesapeake Bay Critical Area Law establishing a Commission authorized to develop criteria for guiding local land-use decisions within a 1000-foot wide buffer strip around the bay's shoreline and along its tributary streams, up to the head of tide (Sullivan, 1986). This buffer zone is known as the "Critical Area." The law mandated local governments to develop management plans for the lands under their jurisdiction that lie within the Critical Area. Additionally, local governments must establish a minimum 100-foot buffer along their shoreline and streams, within which most new structures, roads, septic systems, and impervious surfaces are prohibited. Regulations also require that this 100-foot buffer be maintained in, or returned to, natural vegetation. Local plans were due in December, 1987, and are currently being reviewed by the Commission.

Maryland's approach to wetland setbacks is promising. Although it is too early to tell how successful Maryland's approach will be, Dames & Moore suggests acquiring additional information on their approach as well as carefully monitoring the success of their program over the next few years.

Maine. The Saco River Corridor Act, 38 Maine Rev. Stat. Ann., Chapter 6, established regulations governing development within a corridor defined by the limits of the 100-year floodplain of the Saco River (a minimum of 500 feet and a maximum of 1000 feet on either side). A Resource Protection District was set up to include wetlands, areas where the entire width of the corridor was within the 100-year floodplain, and areas important for either wildlife habitat or scenic value. Within the Resource Protection District very limited uses are allowed; dredging or filling of wetlands and dwelling structures are prohibited. A limited Residential District was established, however, which allows for single family residences as long as there is no encroachment on the 100-year floodplain. Single family residences may have a combined river frontage and building setback of not less than 100 feet (Comer, et al., 1982).

Michigan. Michigan's Natural River Act, Public Act 231 of 1970, was designed to establish a system of designated natural rivers for the purpose of preserving, protecting, and enhancing these river environments in a natural state for future generations. Rivers and their tributaries are nominated for inclusion in the system, studied and a river management plan prepared by the Department of Natural Resources with local assistance. Once a river management plan is adopted by the Natural Resources Commission, lands along a designated reach are managed according to the plan. The principal management tool is zoning regulations adopted by local government units, or in their absence, by state administrative rules patterned after zoning regulations. The Act specifically includes authority to establish structural setbacks from the water's edge and to prohibit or limit the removal of vegetation up to a distance of 100 feet from the water's edge (MDNR, 1978).

Pennsylvania. The Commonwealth of Pennsylvania Department of Environmental Resources uses a 50-foot building setback measured landward from the top of a river channel to regulate encroachment along the floodplains which do not have an identified floodway (Accurti and Keptner, 1982).

Local Regulations. In addition to the state-regulated buffer zones cited above, numerous local governmental agencies in other states have passed ordinances establishing wetland buffer zones or setbacks for the protection of aquatic and wetland habitats (Thurow et. al., 1975; Comer et. al., 1982; Brown and Schaefer, 1987). Boundaries may extend from as little as 25 feet, as was recommended in the Oakland County, Michigan, to as high as 200 feet in Orange County, New York. Numerous local ordinances fall within this range; examples include: 40-foot buffers in New Castle, New York; 50-foot widths in Napa, California, and Dartmouth, Massachusetts, and a 150-foot buffer in Marlborough and Brooklyn, Connecticut (Thurow et. al., 1975).

Recently in Florida, two good examples of locally established buffers can be seen around Apalachicola Bay in the Panhandle and Mosquito Lagoon on the East Central coast. Interestingly, both of these wetland/shoreline buffers were originated to protect shellfish harvesting in the areas. In both areas, shellfishing activities were jeopardized by poor water quality in some locations, primarily resulting from inadequate septic systems.

In early 1987, Franklin County, under pressure from the state (Apalachicola Bay Protection Act of 1985) instituted its Critical Shoreline District Ordinance (Franklin County Ordinance No. 87-1) around Apalachicola Bay, producer of over 90% of the harvested oysters in the state. This ordinance set up a 150-foot buffer zone of critical concern around the bay, extending landward from the DER wetland jurisdictional line. The first 50 feet from the wetland boundary within the Critical Shoreline District was designated as the Critical Habitat Zone (CHZ) within which only

limited, water-dependent development is allowed. The maintenance of natural vegetation is required within the CHZ. Traditional septic tanks are prohibited within the entire 150-foot buffer, yet, aerobic units may be installed within the landward 75 feet of the district.

In late 1986, Volusia County instituted in the county zoning ordinances a set of performance standards by which shoreline and water quality protection could be reasonably insured. Guidelines for two types of buffers were developed, a wetland protection buffer and a shoreline protection buffer. The wetland protection buffer extends 25 feet from the upland limit of any wetland habitat, must preserve the natural vegetation and must meet or exceed the requirements of the shoreline buffer. The shoreline buffer extends 50 feet landward from the mean high water line. Within this zone, no development is permitted except limited water-dependent structures (e.g., boat ramps, docks). No more than 20% or 25 feet, whichever is greater, of any shoreline may be altered.

3. Buffer Zone Regulations in Water Management Districts and Regional Planning Councils

Dames & Moore interviewed staff in all of the water management districts and regional planning councils concerning any wetland buffer zone or setback regulations in effect. The following is a synopsis of our findings.

Water Management Districts. Currently, no buffer zone regulations or rules governing setbacks from wetlands exist for either the Northwest Florida Water Management District (NFWFMD) or the St. Johns River Water Management District (SJRWMD). While the NFWFMD has no plans for establishing buffers, the SJRWMD is proceeding with rulemaking on buffers in the Wekiva River Basin to incorporate the details of the 1988 legislation covering the Wekiva River. The 500 foot buffer cited in the Wekiva bill is to be coupled with Best Management Practices. Development may occur within this buffer zone only if stormwater controls are in place and stabilized prior to construction. The proposed rule is based in part on the Center for Wetland's study (reviewed in Section .1 of this chapter) and its progress should be followed closely.

South Florida Water Management District (SFWMD) adopted its Isolated Wetland Rule in early 1987. The rule was challenged, but upheld, in administrative hearing not on the issue of determination of buffer width, but on the District's authority to create a development setback. The basis for the rule resides in the statutory language stating that natural wetlands and appropriate buffers be preserved. A buffer zone of 25 feet is preserved landward of the wetland control elevation which is determined by SFWMD staff (and should not be confused with a vegetation-based jurisdictional line, e.g., DER's vegetation

rule). In many cases the buffer zone begins at the upper end of the transition zone, which is considered part of the wetlands. The setback is somewhat flexible in that it may be contracted in some areas so that expansion to capture a significant resource can be accomplished in other areas, thus yielding an average setback of 25 feet.

Southwest Florida Water Management District (SWFWMD) currently provides a 15-foot buffer extending landward from the wetland demarcation line. The district, however, has the ability to make changes, if necessary, in the buffer widths on a case-by-case basis. If any threatened or endangered species are present, SWFWMD requires that an additional, unspecified distance be added to the buffer; this distance theoretically has no upper limit.

Regional Planning Councils. In July, 1987, Comprehensive Regional Policy Plans were adopted for the eleven Regional Planning Councils (RPC's) throughout the state. In all cases, language was included, however vague, encouraging local governments to institute requirements for natural, vegetative buffers around wetland habitats. Most of the RPC's stopped short of specifying exact buffer dimensions; instead, local governments are allowed to set their own guidelines.

Only two RPC's interviewed (Treasure Coast and North Central Florida) have specific buffer widths incorporated in their policy language. Treasure Coast RPC set a minimum buffer width of 10 square feet per linear foot of wetland perimeter. This area is used as a minimum value and is coupled with the requirement that no less than 50% of the perimeter should be buffered by this 10-foot wide strip. The North Central Florida RPC requires a 75-foot buffer (measured landward from the commonly recognized river/stream bank) around rivers and streams of regional significance and a 35-foot buffer around all other perennial rivers and streams. Residential, commercial and industrial development is discouraged within these buffer zones; agriculture, silviculture and recreation are allowed subject to Best Management Practices.

4. Review of DER's 10 Year Floodplain "backstop" Rule and Determination of problems with implementation

The Department of Environmental Regulation rules, Chapter 17-4.022(6), states that the landward extent of waters of the state will extend only as far as the elevation of the one in 10-year recurring flood event, or the area of land covered with standing or flowing water for more than thirty (30) consecutive days per year, calculated on an average basis, unless the indigenous vegetation indicates a smaller area or lower elevation should be considered. This is what has commonly become known as the ten year floodplain backstop rule.

Generally, landward extension of surface waters of the state is determined for any waterbody by dominant plant species. If the so-called wetland species predominate, then they are within waters of the state. In some instances, however, these plants may extend for considerable distances from the waterbody in question. If it can be determined that the ten year floodplain does not extend as far as the wetland species, then the ten year floodplain "stops" the jurisdiction for waters of the state.

Dames & Moore interviewed Mr. Rick Cantrell and Mr. Abbas Gerami, who work in the DER's Division of Environmental Permitting, Jurisdictional Evaluation Section, in Tallahassee. The purpose of this meeting was to see how the ten year floodplain backstop rule was applied and what, if any, problems could be determined.

We were able to go over three separate permit applications where the backstop rule was applied. The applications of the rule was straightforward for the streams, except in one instance where a seepage zone was encountered. This presented a situation in which a rather constant seepage of water kept a sizable area wet, although not necessarily inundated, for most of the year. In this case, the area was viewed as a spring discharging into the river, and even though the 10 year floodplain of the receiving river did not encompass the entire seep area, the entire zone was ultimately classified as waters of the state.

In one other example, a lake, the 10-year flood elevation was calculated based on elevations of the river draining the lake and working the calculations back upstream to determine the elevation at the lake. This elevation resulted in a much smaller zone around the lake being considered as waters of the state than what would have been determined based solely on vegetation. The DER accepted this determination and removed from their jurisdiction a portion of the property measuring approximately 150 foot by 300 foot.

5. Conclusions and Recommendations

After reviewing the above planning literature, regulatory approaches and interviewing numerous staff persons in other states and Florida agencies, Dames & Moore observed that most buffer zones being used in other states: (1) have a fixed width about the wetland, (2) appear to be based on little to no quantitative information, and (3) were presented with no rationale for choice of buffer width. For this reason, many jurisdictions have adopted setbacks or buffer zones based on a qualitative methodology. Some of the Florida approaches are more quantitative in that they rely on subsurface hydrologic conditions and ground water movement rates.

Clearly the main advantage of a fixed-width buffer, e.g., 75 feet, is the ease with which it is administered. It is relatively simple to determine whether a proposed development

will fall within the buffer or not. The key weakness of this method is found in its rigidity. For example, the SRWMD's 75 foot setback line is suitable for single family houses, but is probably inadequate to protect against the impacts caused by development of greater density. A flexible buffer, however, varies in width according to the location of specific resources (e.g., specific vegetation types, endangered species habitat). The flexible-buffer approach assures a certain degree of regulatory sensitivity to critical areas along a wetland, while its weakness lies in the need for field investigation and more extensive program administration.

Of all the buffer zones we examined, only two incorporated a flexible-width buffer determination, the New Jersey Pinelands model and the Wekiva Basin model proposed by the Center for Wetlands. (Please note that the St. Johns River Water Management District, at the direction of the legislature, is developing different buffer zones for the Wekiva River.) We feel that the flexible-buffer approach offers considerably more protection for both wetland habitats and wildlife, as well as proposed development, and we recommend that this approach be pursued in more detail.

At the request of the SRWMD staff, Dames & Moore developed a methodology that combines the flexibility of the qualitative approach together with a computer model that utilizes numerical values derived from lot size, development density, soil types and vegetative cover. See Section III for a detailed discussion of this model.

III. TECHNIQUE FOR ESTABLISHING BUFFER ZONES BASED ON THE SOIL CONSERVATION SERVICE TR-55 RUNOFF MODEL

In view of the limited scope of the consultant's contract, Dames & Moore decided it was not possible to develop an entirely new model for a buffer zone. Instead, we turned to the TR-55 model developed by the U.S. Soil Conservation Service (SCS) and widely used throughout the country. Dames & Moore adapted the TR-55 to serve the development of a buffer zone methodology. TR-55 is a simple and widely accepted modeling technique that has been used for many years to calculate the amount of runoff expected for various surface conditions. Because water quality generally depends on the volumes of runoff water that enters surface waters, it was felt that a technique which looked at this parameter would serve as a useful method by which buffer zones could be determined. If the amount of runoff from land being disturbed in some manner can be minimized, then the attendant pollutants reaching the rivers and lakes also would be minimized.

The SCS TR-55 model calculates amounts of water running over the land surface based on several factors such as, type of soil, vegetative cover, slope and percentage of impervious surface. The SCS has determined how much water can be expected to run off

an area and has assigned numbers, known as curve numbers (CN), to many differing types of soils and cover. It also divided all named soils in the U.S. into four hydrologic groups from A through D; where A has the lowest potential for natural runoff and D has the highest, all other parameters being equal. An area with a high CN will have more water runoff than an area with a lower CN. The TR-55 manual, provided by the SCS, lists the CN values for the four hydrologic soil groups, broken down by various types of cover, development and hydrologic condition.

Water classified as runoff travels in three ways across the land: 1) as sheet flow over the entire surface area, 2) as channel flow, such as rivulets and streams, and 3) as shallow subsurface flow in the upper few inches of the soil. Sheet flow was selected as the key factor in the development of the buffer zone methodology because an undisturbed buffer zone will act to slow sheet flow, thereby reducing erosion and allowing pollutants to drop out before reaching the river. The SCS has demonstrated that the maximum distance that sheet flow can occur before becoming either channelized or shallow subsurface flow is 300 feet; therefore, this was the distance chosen to represent the maximum available buffer zone for the hypothetical lot along a waterbody.

Five scenarios were used to develop the buffer zone model, based on land use landward of an undisturbed buffer zone along the river's edge. These are presented as cases one through five. Table 1 briefly describes each case and gives the corresponding CN for the area landward of the buffer zones for typical conditions.

These five cases were chosen to represent typical conditions one might expect to encounter as an undeveloped area gradually becomes more developed. The CN values given for each case are merely representative values and may be higher or lower for individual situations, because of variations in the natural vegetative cover. It is assumed that an undisturbed/undeveloped site (case 5) consists of a lot with substantial tree cover and a brush/grass/weed understory and ground cover. These physical conditions present a great deal of resistance to runoff, allowing water adequate time to soak into the ground before it reaches an open body of water.

The next level of development (case 4) is the "cabin in the woods," in which some minor site alteration occurs, but most of the trees are left intact and there is very little clearing of the surrounding lot, which is still mostly brush/weed combination.

The middle case (case 3) represents a typical single family home in which most of the underbrush and ground cover is replaced by lawn grass, and up to 20% of the total lot area is converted to impervious surface (such as roof, deck, driveway, sidewalk, bare

packed ground). This is the predominant type of development currently taking place along the rivers in the district, and which the district considers as the baseline for assessing all other types or densities of development.

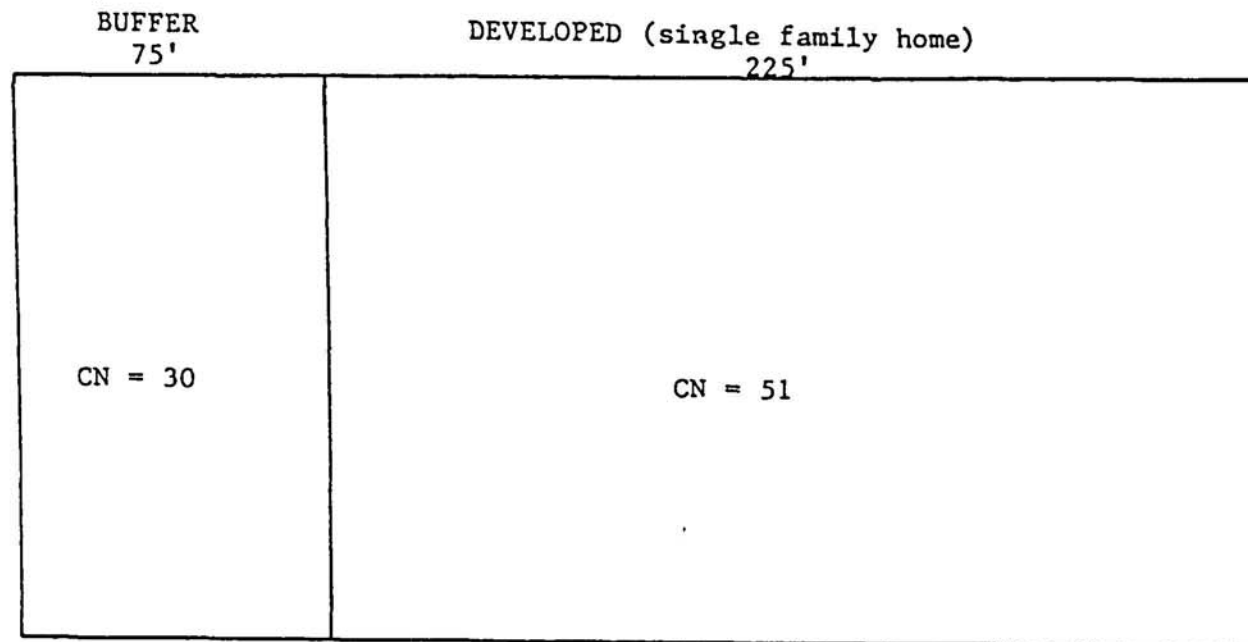
Case 2 represents a higher density of development along the waterbody, such as multi-family housing or some similar high density use having a total impervious surface area of between 40% and 65%, and very little natural vegetation left other than a few trees.

Finally, case 1 can be thought of as the "worst case" of site alteration in which 90% or more of the total lot is impervious, or nearly so, such as bare hard packed ground or a parking lot surface. Each of these cases (as well as all other cases) will have a varying CN, depending on the type and amount of vegetation on the lot, for a particular soil group.

Table 1 - CN for area landward of buffer zone

<u>Case Description</u>	CN				(soil type)
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	
1 impervious area (bare, packed soil)	98	98	98	98	
2 dense development; severe disturbance	77	85	90	92	
3 single family house with grass yard	51	68	79	84	
4 small cabin; minor disturbance	36	60	73	79	
5 undisturbed; undeveloped	30	55	70	77	

The CN for case 5 (the undeveloped or naturally existing site condition) in each soil type is used as the CN value for the buffer zone. A composite CN for a lot with a specific buffer zone and type of development is calculated by proportioning the buffer zone width to that of the remaining width (300 feet minus the buffer zone width). As an example, assume a buffer zone of 75 feet having a CN of 30. (See Figure 2.) A development is to be placed in the 225 feet behind this buffer zone which will have a CN (for the developed portion only) of 51. The composite CN for the entire 300 feet length is then calculated to be 46, as follows:



$$\text{COMPOSITE CN} = \frac{75 * 30}{300} + \frac{225 * 51}{300} = 46$$

Figure 2 - Example of Composite CN Calculation

COMPOSITE CN vs BUFFER ZONE

HYDROLOGIC SOIL GROUP A

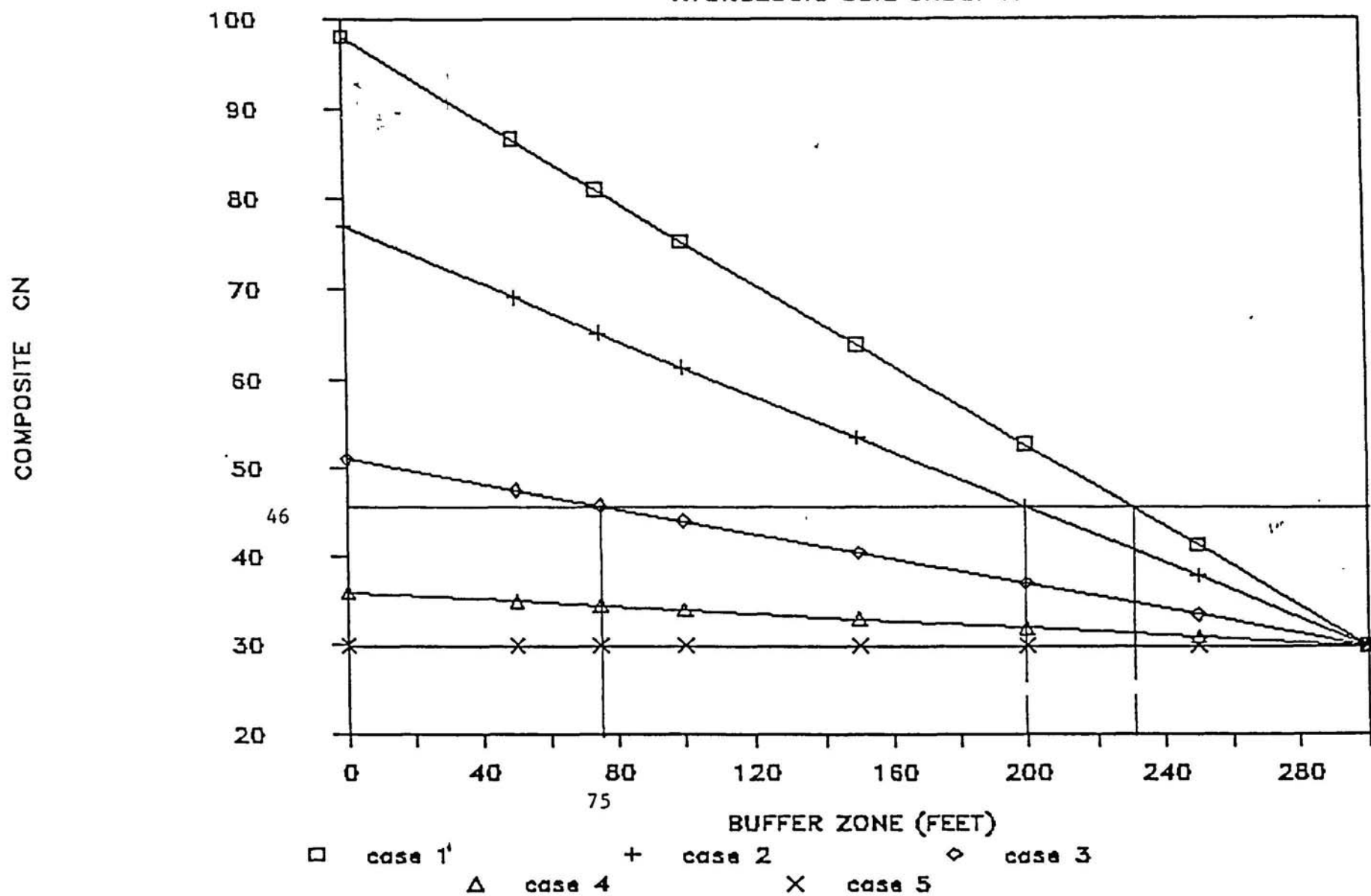


Figure 3.

$$\frac{(75)}{(300)} 30 + \frac{(225)}{(300)} 51 = 46$$

Composite CN values were calculated for each case within each soil group using varying widths of buffer zones for each 300 foot lot. As the buffer zone gets wider for each particular case the composite CN for the entire lot becomes smaller, until the entire 300 feet becomes a buffer zone and the composite CN for all cases is the same as the undeveloped lot. Obviously in this extreme situation the ability to develop the property as proposed is not feasible. At the point, the district staff and the applicant must negotiate an acceptable level of development that will most likely involve structural water management features (such as retention ponds) as well as a buffer zone.

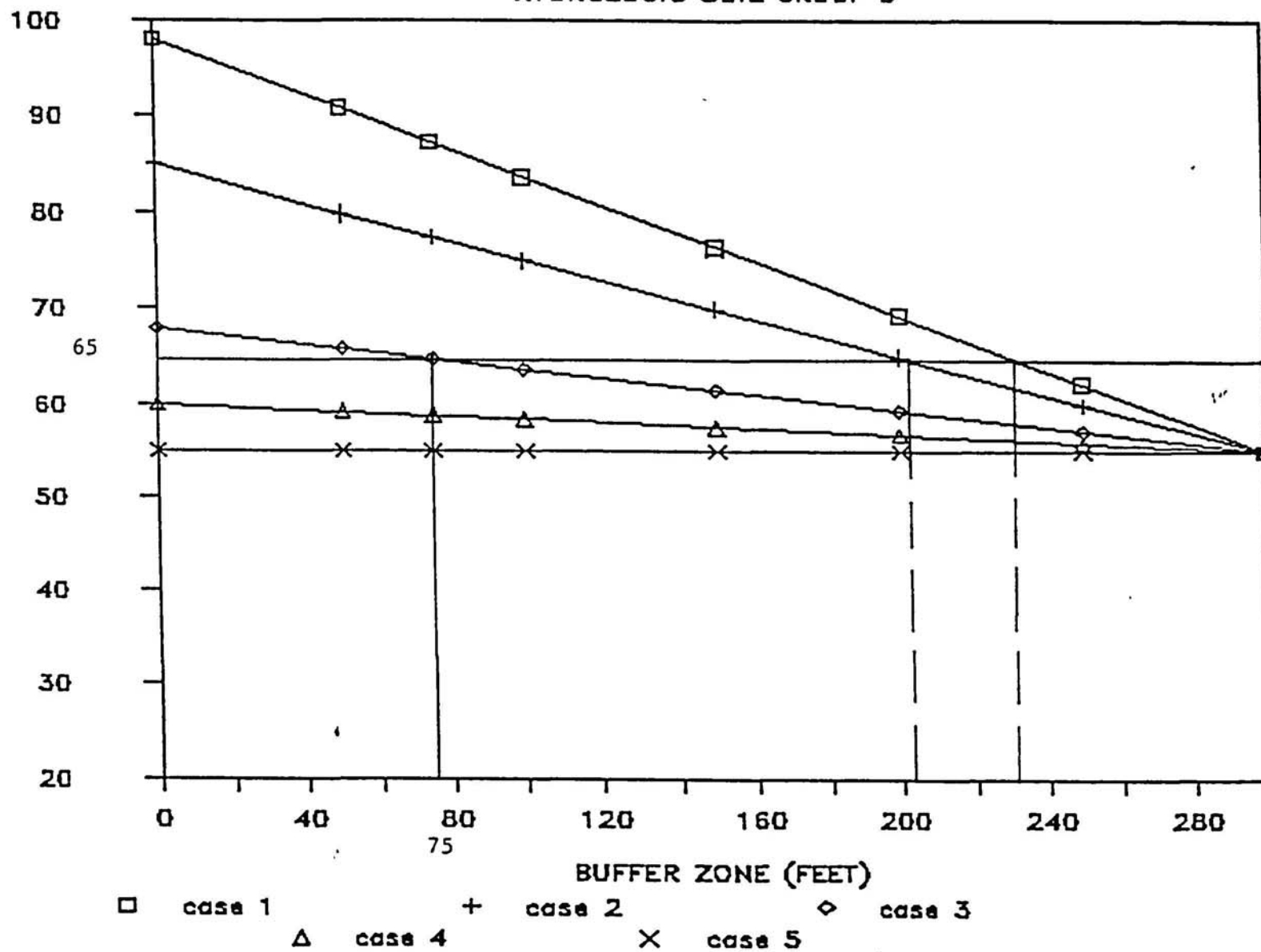
Sets of graphs were developed using this methodology for hydrologic soil type A to D (Figures 3 through 6). Each graph compares the effect of development type to varying buffer widths. Each graph consists of a set of sloping straight lines, each one representing a particular level of development for the area landward of a buffer zone. The buffer zones were assumed to have a CN value corresponding to the naturally occurring state prior to any disturbance. For this reason, the bottom line on each set of graphs is horizontal, indicating that when no disturbance occurs behind a buffer zone, no change occurs in the runoff characteristics for the entire length.

These graphs illustrate the effect of increased disturbance or development on the CN value and the effect of increasing the buffer zone for a particular type of activity on the CN. The greater the disturbance, the greater the potential runoff; the wider the buffer zone, the lower the potential runoff.

In order to make practical use of this method, each individual site must have its buffer zone CN determined based on the soil type and cover existing on the site prior to any development. It is also necessary to establish a maximum value for an acceptable composite CN for each particular lot. To do this, the current SRWMD policy of allowing a single family dwelling to have a setback of 75 feet is utilized. By entering the graph along the X-axis at a value of 75 feet and picking the point along the line corresponding to the single family dwelling (case 3), a maximum composite CN for the graph is established. Activities which maintain a composite CN of this value or less will be able to have the minimum 75 foot buffer zone. Development that causes a greater disturbance will need to have larger buffer zones. This larger buffer zone can be determined from the intersection of the sloping line representing the proper level of disturbance with the maximum CN allowed and reading down to the value for buffer zone width.

COMPOSITE CN vs BUFFER ZONE

HYDROLOGIC SOIL GROUP B



COMPOSITE CN vs BUFFER ZONE

HYDROLOGIC SOIL GROUP C

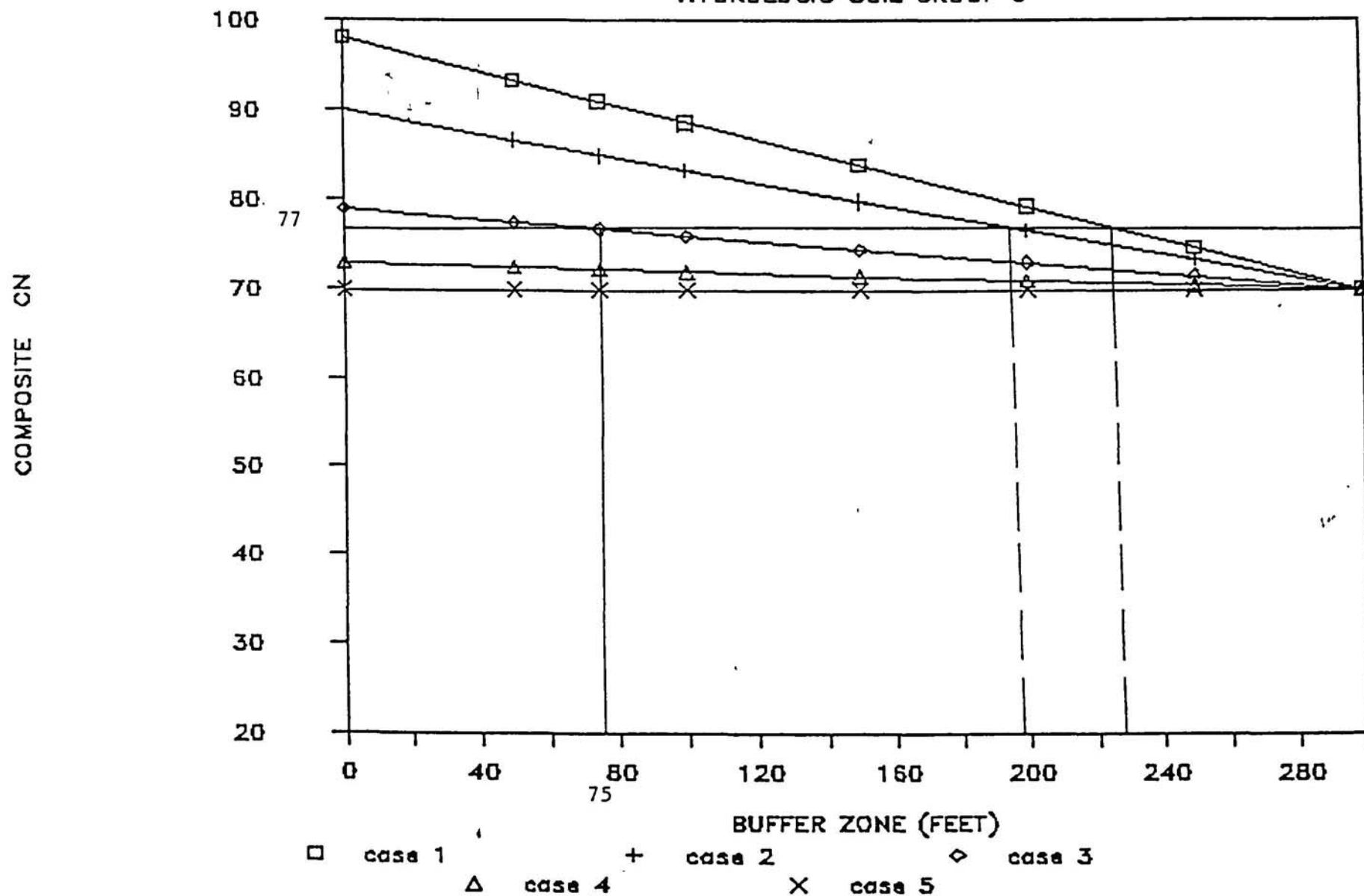


Figure 5.

COMPOSITE CN vs BUFFER ZONE

HYDROLOGIC SOIL GROUP D

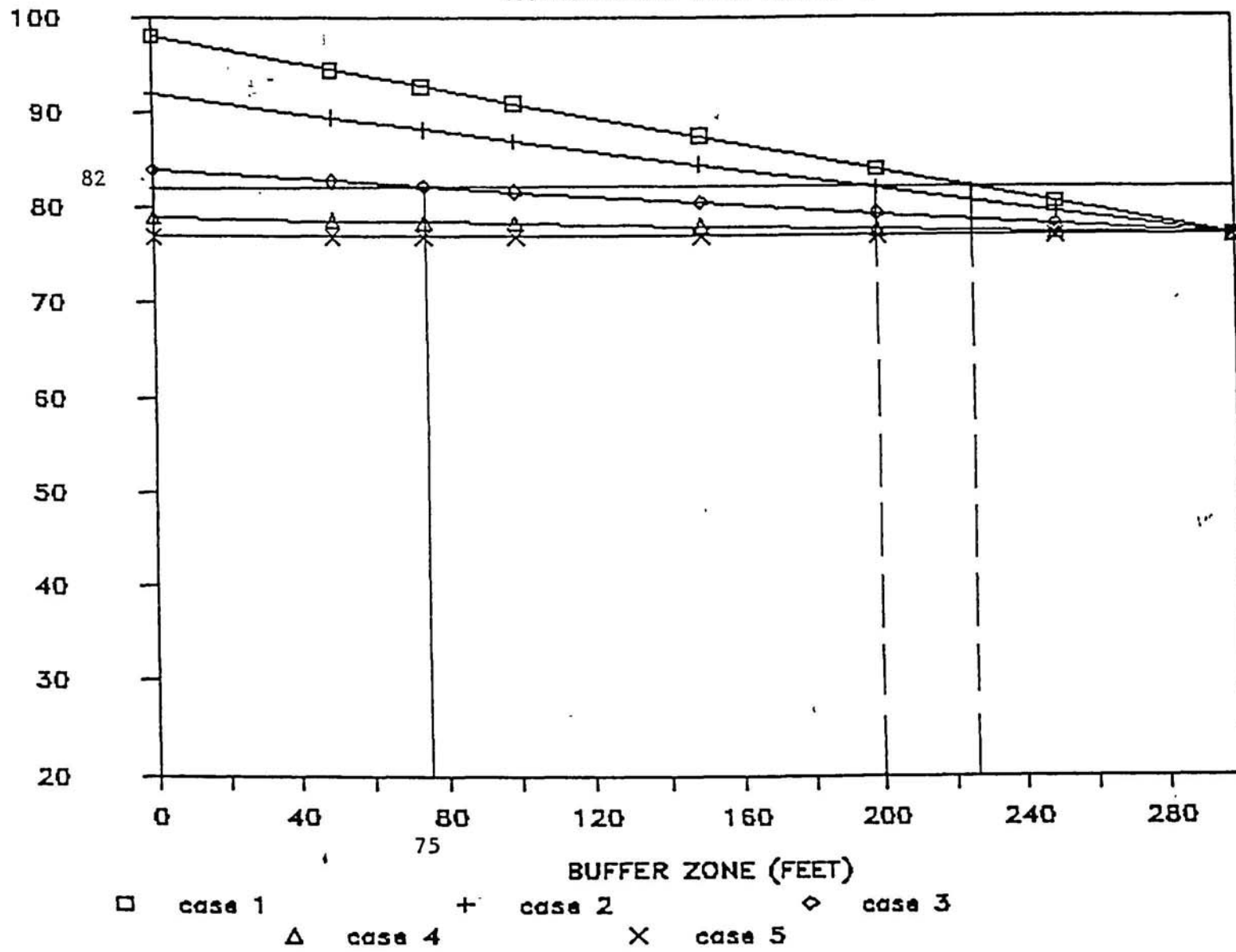


Figure 6.

Figure 3, is an example graph for a typical hydrologic soil type A, having an undisturbed CN value of 30. The composite CN for a single family residence (case 3) having a setback of 75 feet is found to be 46. Any line in this figure which lies above the case 3 line (meaning a higher level of development or disturbance) will cross the CN = 46 line where the buffer zone value is greater, meaning that a greater amount of site alteration requires a larger buffer zone. In this figure, the case 2 line crosses the CN = 46 line where the buffer zone is 200 feet therefore, any activity which is represented by the case 2 line needs a 200 foot buffer zone.

After developing the buffer zone methodology, we applied it to five sites at three locations along the Suwannee River. These three particular locations were chosen because they represent fairly typical cross sections of the conditions most likely to be encountered along the Suwannee River. Three out of four hydrologic soil groups are represented, as well as varying amounts and type of vegetative cover. A map of the Suwannee River showing the approximate location of each of these sites is presented in Figure 7. Detailed maps of each site are shown in Figures 8 through 10. The three locations were designated as (1) Upper Suwannee, (2) Middle Suwannee, and (3) Lower Suwannee. Field reconnaissance by SRWMD personnel provided the necessary input information at each site. The Upper and Lower locations each had two sites, one located along each bank and designated as north, south, east, or west. Table 2 summarizes the field conditions found at each site, and gives the required buffer zone distance for high density development (case 2) as determined from the set of graphs prepared for each site.

Site	Hydrologic Soil Type	Vegetative Cond. Canopy Ground	Existing Site CN	Case 3* CN	Buffer Zone,ft
1N	D	woods 30%	79	84	215
1S	A	woods 25%	45	51	260
2	B	woods 30%	66	68	275
3E	D	woods 50%	82	84	250*
3W	B	woods 25%	60	68	235

*the case 3 CN is the single family house benchmark condition.

Graphs for typical conditions in hydrologic soil groups A through D are included in this report (Figures 6 through 6), along with graphs the for five specific sites along the Upper, Middle and Lower Suwannee River (Figures 11 through 15).

The methodology developed by the consultant and described in this report, is an effective method for determining buffer zone distances around waterbodies in the SRWMD using the concept of water runoff relationships as they are affected by changes to the land surface. This technique for determining effective buffer